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The Editor's Page

George H. Johnson, for many years in charge of research work at the American Institute of Laundering, Joliet, Ill., has been elected general manager of the Institute succeeding Lloyd Peck. Arthur I. Anderson, who has been associated with Mr. Johnson for some ten years, succeeds him as director of the department of research and textiles.

* * *

THE third progress report of U. S. Institute's textile drying project, which is being conducted at the National Bureau of Standards, Washington, D. C., was mailed to co-operators early last month. It contained description and five photographs of the equipment that is being used, also results of a few preliminary regain tests on various fibres and yarns.

* * *

DIRECTORS of the Textile Foundation, at their annual meeting in Washington, April 21, decided to concentrate their future work in scientific research on studies of fundamental problems which are basic to the entire textile industry. To this end, allotments of funds have been made on a long-time basis and the following group of advisors has been appointed to plan and establish the scientific research program: Dr. R. E. Rose, director, du Pont Technical Laboratories, Wilmington, Del., chairman; Dr. Harold DeWitt Smith, A. M. Tenney Associates, New York, N. Y.; Mr. Alban Eavenson, Eavenson & Levering Co., Camden, N. J.; Dr. H. S. Taylor, Princeton University; Mr. Warren E. Emley, National Bureau of Standards; and Dr. A. G. Black of the Department of Agriculture. A large part of this work will be done at the National Bureau of Standards, but certain fields have been set aside for Lowell Textile Institute, Massachusetts Institute of Technology and Yale University.

* * *

THE Chemical Foundation will elect no immediate successor to its president, the late Francis P. Garvan, who held that office during the eighteen years he directed the Foundation and played a major rôle in the development of the American chemical industry. Wheeler McMillen, who has succeeded Mr. Garvan as president of the National Chemurgic Council, and is editorial director of *The Country Home,* has been elected a director and vice-president of the Chemical Foundation, and becomes the ranking officer of the Foundation. William W. Buffum, treasurer and general manager of the Foundation, announces that support of research development in the chemical, scientific and medical fields will be continued, with particular emphasis upon activities connected with the establishment of new chemurgic industries through the use of farm products as industrial raw materials.

A SUMMER Session program in Principles of Textile Analysis is again announced by the Massachusetts Institute of Technology. The course will be given, for six weeks beginning July 25, in the textile laboratories under the direction of Prof. E. R. Schwarz; it will include lectures, demonstrations illustrated by experiments, lantern slides, and moving pictures, together with laboratory exercises in physical analysis of textiles, textile microscopy, and principles of fabric structure. It is offered for the benefit of laboratory technicians, teachers of household economics, students from textile schools and others interested in textile research and is a single comprehensive program. The facilities of the laboratories have been substantially increased and equipment has been rearranged for more efficient class use. So far as possible the material will be presented in a manner to be of interest and value to the teacher of these and allied subjects, to the laboratory technician, to the executive who must interpret research results for the benefit of his organization, and to the student who seeks an up-to-date orientation course in the physical and optical analysis of textile materials of all kinds.

* * *

Dr. J. R. Katz, who acted as director of U. S. Institute's warp sizing research during its first six months, died of a heart ailment in Belmont, Mass., April 19, in his 58th year. He was a native of Amsterdam, Holland, and had been a Professor of Chemistry at Amsterdam University, specializing in starches and other substances of high molecular weight. He is survived by his widow and a sister. Cremation followed funeral services at Bigelow Chapel, Mt. Auburn Cemetery, Cambridge, Mass., April 22nd.

* * *

Adjourned Annual Meeting

Amendments of By-laws to be Acted Upon—Conference of Co-operators in Drying Research

THE annual meeting of members of U. S. Institute for Textile Research, adjourned from Nov. 12, 1937, is to be held at the Hotel Pennsylvania, New York, N. Y., at 11 A.M., Tuesday, May 24, 1938. In addition to the election of directors whose terms have expired or who have resigned, the most important item of the agenda will be the discussion and action upon the report of the Committee on Revision of the By-laws, the members of that Committee being Alban Eavenson, Chm., W. E. Emley, Dr. Robert E. Rose, Dr. H. DeW. Smith. Another notable feature of the meeting will be a report of Acting-President Dr. Killheffer on the plan for a textile research institute which he was authorized by the annual meeting, Nov. 12 last, to present to the Textile Foundation.

A meeting of the Board of Directors will also be held in the afternoon for election of officers for the current year. Directors whose terms have expired or who have resigned are as follows: John Bancroft, Jr., J. E. Edgerton, P. A. Johnson, Charles B. Nichols, Robert E. Rose, H. V. R. Scheel, Harold DeW. Smith, P. J. Wood. G. E. Hopkins, resigned.

The Executive Committee has held two meetings since Nov. 12th, and its report by Dr. Killheffer, and that of the Committee on Revision of the By-laws, to be presented at the adjourned meeting, will contain a number of important recommendations which both of these Committees consider essential for the more efficient operation of U. S. Institute for Textile Research and of the services it renders to the textile industry.

Pursuant to Article X of the By-laws the committee on their revision presented their proposed amendments to the Secretary, and he enclosed a copy of them to each member with the call for the adjourned annual meeting and 30 days prior to the date of the latter. The By-laws have been amended but once since their adoption Nov. 6, 1930, those amendments having been adopted Feb. 24, 1931.

Conference of Drying Research Co-operators

Following luncheon there will be a conference of co-operators in the financing of the textile drying study, now in progress at the National Bureau of Standards. Chairman W. E. Emley of the Research Council will preside, and J. G. Wiegerink, director of the study, will report on recent results and the program of future work. Opportunity for discussion and suggestions by co-operators will follow.

* * *

Luncheon in Honor of English Guests

A LUNCHEON in honor of Mr. Frank Nasmith, president of The Textile Institute, Manchester, Eng., and Mr. J. R. S. Goodall, chairman of the diplomas committee of that organization, will be given by U. S. Institute for Textile Research at the Hotel Pennsylvania following the adjourned annual meeting to be held Tuesday, May 24th, in New York City. Messrs. Nasmith and Goodall will be visiting this country as an official delegation of The Textile Institute to survey the possibilities of increasing its activities here. It has a membership in the United States of over 50, a majority of which are also members of U. S. Institute for Textile Research. Dr. Harold DeW. Smith, a vice-president of U. S. Institute and vice-chairman of the Research Council, is acting for The Textile Institute, of which he is a member, in arranging the itinerary of the delegation, and further details of the latter and of the luncheon in honor of Messrs. Nasmith and Goodall will await their arrival.

Mr. Nasmith has been prominently identified with The Textile Institute for many years, and, prior to his election April 27th as president, was a vice-president and honorary secretary. He is well known in this country as executive manager for Great Britain of the Universal Winding Company, with main plant in Providence, R. I., and head offices in Boston; he is also managing director of Unisel Limited. Mr. Goodall is a member of The Textile Institute Council, as well as chairman of its diplomas committee.

A Study of the Composition of the Ether Soluble Fraction of Raw Silk

By WERNER BERGMANN *

A Textile Foundation Publication

Summary

The ether soluble fraction of white Chinese silk has been prepared and analyzed. The "silk wax" was found to consist of a mixture of normal primary alcohols and acids of the order $C_{20}-C_{32}$, paraffins of the order $C_{25}-C_{31}$ and liquid fatty acids.

Introduction

ONE HUNDRED AND THIRTY YEARS ago, Roard [1] demonstrated in his classical study of the composition of silk, that raw silk contains about 0.5% of a wax like, alcohol soluble component. Roard's observations were verified and extended by Mulder [2] in 1836, whose findings are shown in Table I. According to Mulder the alcohol-ether extracts of

TABLE I

Alcohol and Ether Soluble Fraction of Raw Silk (Mulder)

	Yellow silk	White silk
Soluble in alcohol	1.48%	1.30%
Soluble in ether	0.01%	0.05%

raw silk consist of a mixture of wax (cerin), fat and resin, and in case of the yellow silk also of pigment. Later investigators (3) estimated the alcohol-ether soluble part of the raw silk to be 1–1.5%, and that of cocoon silk to be 2.8–3.2%. The total extracts of cocoon silk contained 0.75–1.0% of the silk in form of a wax like material, and 1–1.2% of water soluble acid substances. The silk wax is always to be found in the ether soluble fraction of the combined alcohol and ether extracts. Its weight rarely exceeds 1% of raw or cocoon silk. The weight of extracts from silk reeled in baths rich in chrysalis fat is somewhat higher, due to the contamination of the wax by oily, ether soluble materials.

The first chemical study of the fraction containing the silk wax was made by Oku [4] 120 years after its discovery by Roard. Oku found that the extract obtained from cocoon silk consists of a mixture of alcohols like ceryl- or myricyl-alcohol, of hydrocarbons like hentriacontane, of higher acids like melissic acid and various lower fatty acids. On the basis of

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the results of his analysis, Oku concluded that silk wax showed a great resemblance to bee's wax.

Composition of the Ether Soluble Fraction of White Chinese Raw Silk

During the past years the author[5] has been engaged in a systematic study of the role played by certain lipoids during the life cycle of the silkworm, "Bombyx mori." Included in these investigations was a comparative study of the ether soluble material of white Chinese raw silk, the results of which are the subject of the present communication. The ether extract of 2018 grams of silk, a light brown wax, weighed 10.884 gm. or 0.54%. It showed an indefinite melting point of 50–65°. On saponification it yielded between 55 and 60% of a nonsaponifiable material of an indefinite melting point of 50–65°. The nonsaponifiable fraction showed none of the typical ractions for sterols, indicating the absence of this group of compounds. The use of the phthalic ester method of Chibnall and others[6] permitted the separation of the nonsaponifiable material into primary and secondary alcohols and hydrocarbons. Secondary alcohols were found, however, only in such small quantities as to make their identification impossible. The primary alcohols represented about 35% of the original extract. After purification they showed a melting point of 80–81° and appeared to be a mixture of alcohols of the order of $C_{26}H_{54}O$ to $C_{32}H_{64}O$. The hydrocarbons, which represented 25% of the total extract, showed a melting point of 60.2–61° after purification with concentrated sulfuric acid. Analytical data indicated that one had to deal here with a hydrocarbon of the formula $C_{27}H_{56}$ or $C_{28}H_{58}$. Since, however, Chibnall[7] has shown that even numbered paraffins do not occur among the hydrocarbons of natural waxes, but that they consist of mixtures of one or more of the odd numbered hydrocarbons, $C_{25} - C_{37}$, it is to be assumed that the paraffin of silk is a mixture of hydrocarbons of the order $C_{25} - C_{31}$.

The alkaline part of the saponification mixture contained a suspension of rather insoluble salts from which an acid of the melting point of 90° was obtained. This acid, which represented about 11.5% of the original extract, showed the composition of octacosanic acid. Since, however, as has also been shown by Chibnall,[7] saturated wax acids as a rule are mixtures of even numbered normal fatty acids from $C_{24} - C_{34}$, it must be assumed that the acid of silk wax is a mixture of acids of the order $C_{26} - C_{32}$.

From the soluble salts obtained on saponification of the extract, 20% of an acid mixture was obtained, which contained, besides very small amounts of solid acids, mainly liquid unsaturated acids.

The results of the present analysis stand in good agreement with those obtained by Oku.[4] The difference in the relative amounts of primary alcohols and hydrocarbons, as evidenced by a comparison of the respective data shown in Table II, is most likely due to the method chosen for the

TABLE II

Composition of the Ether Extract of Raw Silk

	Oku	Bergmann
Primary alcohols	51.5%	35%
Hydrocarbons	11.5%	25%
Higher acids	11.5%	11.5%
Lower acids	25.5%	20.0%

separation of the two groups of compounds. The procedure used in the present study is more accurate than the one employed by Oku.

Discussion

Apart from the ill-defined liquid acids, the ether extract of raw silk contains three major components, namely normal primary alcohols and acids of the probable order $C_{26}-C_{32}$, and hydrocarbons of the probable order $C_{25}-C_{31}$. In this respect the "silk wax" closely resembles the components of the cuticles of plants which have been the subject of a series of brilliant investigations by Chibnall and collaborators. It also closely resembles the cuticulin of the silkworm *Bombyx mori*. This interesting compound which has recently been isolated and investigated by the author[8] is the principal component of the epicuticle, or the extremely thin wax-like film, which covers the cuticle or the skin of the worm. One of the principal properties of waxes of this type is their resistance against the action of chemicals. Mulder[2] has already pointed out that silk wax is not affected by warm concentrated hydrochloric or nitric acid. It is also well known that paraffins of the type present in silk wax are resistant even against warm concentrated sulfuric acid. The silk wax obviously confers upon the underlying layers of silk protein the same protection against excessive humidity and desiccation as the epicuticle of the insects does to the chitinous layer, and as the cuticle of the plants does to the layers of cellulose.

Whether the components of the silk wax are of endogenous origin, in other words produced by the life processes of the worm itself, or whether they are of exogenous origin and derived from the food, are questions which as yet cannot be answered with any degree of certainty. In a preliminary investigation the author has found that the shiny, wax-like surface layer of the mulberry leaf contains the same components as found in the silk wax. Since the worm consumes considerable quantities of leaf wax during its life time, it seems very likely that the worm utilizes a part of it to satisfy its wax requirements for the production of cuticulin and silk wax. The exogenous origin of cuticulin and silk wax appears to be more probable than endogenous synthesis. The amount of wax consumed by the worm, however, is much greater than its possible requirements. Consequently, considerable quantities of leaf wax leave the digestive system of the worm unaltered and can be isolated from the droppings, as has also been found by the author of this communication.

Analytical Part

Preparation of the Ether Extract of Raw Silk: Samples of Chinese white raw silk, weighing about 100 gm. were refluxed for 24 hours each with 80% ethyl alcohol and 95% ethyl alcohol. The silk was then extracted with ether in a large Soxhlet apparatus for 72 hours. The alcoholic extracts were concentrated to about 100 cc., when the extracted material began to deposit a precipitate. The concentrate was diluted with water and the precipitated material extracted with ether. All ether extracts were then combined and evaporated to dryness. The residue was redissolved in ether, the solution filtered from small amounts of insoluble material and evaporated to dryness. 2018 gm. of silk treated in such a manner gave

10.884 gm. of extract or 0.54%. The extract was a brown solid material of waxlike properties.

Saponification: 10 gm. of the extract were refluxed for 6 hours with 150 cc. of a solution of 10% potassium hydroxide in 90% ethyl alcohol. The solution was then diluted, and after cooling agitated with 300 cc. of water, and after cooling thoroughly agitated with 150 cc. of ether. The lower layer, which was an emulsion of aqueous alcohol, ether and suspended solid matter, was separated from the supernatant ether and centrifuged. During this process the solid materials collected at the interface ether-water and could be readily removed. They were suspended in ether and the resulting emulsion was centrifuged, a procedure which was repeated several times. The solid matter consisted of insoluble potassium salts (Fraction A). It was dried in vacuo and thoroughly extracted with ether.

The aqueous alkaline layer (Fraction B) of the saponification mixture was extracted with ether several times. All ether extracts were then combined and washed with water. The washings were added to fraction B. Aftr drying over anhydrous sodium sulfate the extracts were evaporated to dryness. The nonsaponifiable matter obtained thereby represented about 65% of the starting material.

Isolation of the Primary Alcohols: A mixture of 6 gm. of the non saponifiable matter, 6 gm. of phthalic anhydride and 5 cc. of pyridine were heated for 12 hours at 120°. The molten mixture was then poured into diluute hydrochloric acid. The separation of the precipitated material into the sodium salts of primary and secondary alcohols and hydrocarbons, as well as the subsequent isolation of the alcohols, was carried out in close accordance with the method worked out by Chibnall and collaborators.[6] The fraction containing the primary alcohols, m.p. 78–80°, represented about 35% of the silk extract. After three crystallizations from alcohol the material showed a melting point of 80–81°.

Analysis: Found, C = 81.78% and H = 14.37%.
Calculated for $C_{28}H_{58}O$, C = 81.86% and H = 14.24%.

Isolation of the Paraffins: The fraction containing the hydrocarbons and soluble sodium salts of the phthalates of secondary alcohols represented about 25% of the starting material. On recrystallization from alcohol, an impure brown mixture of hydrocarbons of the melting point 56–58° was obtained. For further purification the crude material was treated with concentrated sulfuric acid at 110° for half an hour, whereupon considerable charring occurred. The mixture was then poured into water and extracted with ether. The ether soluble material was subjected to two more treatments with sulfuric acid until only a slight discoloration took place. After two recrystallizations from ether and alcohol, the paraffinic hydrocarbons showed on heating an indefinite first transition point, a second transition point at 56.8–57°, a melting point of 60.2–61°, and on subsequent cooling a settling point at 59.2°.

Analysis: Found, C = 84.98% H = 14.83%
Calculated for $C_{27}H_{56}$, C = 85.15% H = 14.86%

From the mother liquors of the first crystallization of the paraffins only a very small amount of the sodium salts of secondary alcohols was obtained. They were not further investigated.

Isolation of the Higher Acid: The insoluble salts (Fraction A) obtained during the saponification of the silk extract were suspended in dilute sulfuric acid, and the mixture heated gently on the water bath until the free acids had separated. After cooling, the acids were filtered, washed thoroughly with water and recrystallized several times from methanol. The purified material showed a melting point of 89–90°. The yield of higher acids was estimated to be 11.5%.

Analysis: Found, C = 79.23% H = 13.35%
Calculated for $C_{28}H_{56}O_2$, C = 79.11% H = 13.30%

Isolation of the Lower Acids: The alkaline solution of the saponification mixture (Fraction B) was acidified and the fatty acids extracted with ether. The ether extract, after washing and drying, was evaporated to dryness. The residue was a brown oily mixture of acids and represented about 20% of the starting material. On separation of the acid mixture into solid and liquid acids by the method of Twitchell, only 77 mg. of solid acids of the melting point of 75–85° were obtained. They were not further investigated. The liquid acids showed an average molecular weight of 176 and an iodine number of 85.6.

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Wool bagging designed to eliminate the jute-in-wool fibre difficulty is made of 40% wool and 60% paper yarn, and Bradford, England, reports of its experimental use are favorable despite its relatively high cost. However, unless for the yarns of the wool-paper bagging, used in baling merino wools, care is taken to eliminate kempy and coarse crossbred wools, the damage caused by the presence of the latter in fabrics woven from wools thus bagged will be scarcely less than that caused by jute fibres.

Fundamental Properties of Textile Wastes. III. Gas Bubbles

By PHILIP H. BURDETT *

A Textile Foundation Publication

IT is a characteristic of small particles to acquire an electric charge on passing through a chemically different medium. This fact was first recorded by Quincke,[26] who found that the air near the bottom of a waterfall was negatively charged. Since then numerous observers have noticed this effect, not only with waterfalls but anywhere where small particles are passing through a chemically different medium.

Gilbert and Shaw [16] have divided the study of potential difference at the liquid-gas interface into nine sections:

1. The potential difference at the interface liquid-gas when both phases are at rest.
2. The measurement of cataphoresis of gas bubbles in a liquid.
3. The passage of a gas over a liquid without rupture of the latter.
4. The fall of a liquid in a gas in an unbroken column.
5. The expulsion of a liquid into a gas from jets.
6. "Waterfalls."
7. The bubbling of a gas through a liquid.
8. Drop-splitting: the shattering of drops by the impact of a flowing gas.
9. The spraying of a liquid, as in an atomizer.

Several of these, such as three and four, have been found to yield little or no result but our interest is limited further by the nature of the problem at hand. We are interested in what happens when air is bubbled through textile wastes. While it seems quite probable that the phenomena in this case, whatever they may be, are similar to those occurring with other small particles than gas bubbles, this cannot be taken for granted and no conclusions regarding the relation between the various phenomena can safely be drawn until a large amount of data has been collected in all these related fields. We must concern ourselves, therefore, strictly with gas bubbles, for the present at least. The divisions already suggested which lend themselves to this study are obviously the cataphoresis of gas bubbles and the bubbling of gases through liquids. Considerable work has been done in each of these fields but there is yet much to be done, particularly in relation to our special problem.

* Mr. Burdett is a Junior Investigator of the Textile Foundation, working under the direction of Dr. Frank K. Cameron at the University of North Carolina, Chapel Hill, N. C.

Any historical discussion of this field might easily lead astray by a consideration of the extensive bickering over the theoretical interpretation of the observed facts. There are, however, at last two reasons for avoiding this at the present time. In the first place, what happens is of much more interest than how or why it happens; in the second place, the data at the present time are entirely insufficient for the support of any theory. For these reasons we will not concern ourselves with the nature of the "double layer," or whether the effects which we observe are due to adsorption of ions or to the orientation of water molecules on the surface of the bubble.

Keeping in mind the fact that most of the work so far has been done in support of one or another of these theoretical positions with which we are not concerning ourselves, we may go over the chief experimental developments up to the present.

Historical

As we have already mentioned, Quincke [26] first noted the fact that the air near the bottom of waterfalls is negatively charged. Lenard [22] did the first systematic work and described many characteristics which are still recognized today. He called the phenomenon "waterfall electricity" and he investigated several liquids falling in several gases. Following Lenard came J. J. Thomson,[28] who studied the effect of different gases and the effect of the presence of small amounts of impurities in the liquid phase. His method was to study the change in conductivity of the gas in a Faraday cylinder. He and Lenard, along with later workers, including Becker,[2] Kahler,[17] and Christiansen,[9] noted the effect of electrolytes in water and found the charge was usually reduced and often reversed on the addition of electrolytes. Kelvin, MacLean and Galt [20] found this reversal in every case of added electrolytes but they also found in most cases that, with increasing concentration of electrolytes, a maximum positive charge was reached after which the charge fell off gradually and finally reversed again. Nolan and Gill [25] reported, on the other hand, that in experiments in which the liquid was sprayed from an atomizer, sodium chloride lowered but never reversed the charge in concentrations up to 2.5 N.

Christiansen [9] gave the better name of "ballo-electricity" to the general phenomenon and did extensive work on the spraying of liquids into gases, particularly in respect to the effect of small amounts of electrolytes. Freundlich [14] did a considerable amount of work on waterfalls but the theoretical side of the problem seems to have attracted his attention more than the experimental.

On the groundwork provided by these men many others have made improvements of technique and have extended the number of conditions studied. Among those who seem to have made important contributions are Frumkin,[15] Buhl,[5] Schulman and Rideal,[27] Chapman,[8] Kamienski and Goslawski,[18] Kamienski and Inglot,[19] and Chalmers and Pasquill.[7] The latter have devised a set-up which apparently allows the direct measurements of the potential difference between a liquid dropping through a tube and the gas in the tube.

Faraday [12] carried out extensive experiments on steam jets and found that the pure gas would not pick up a charge on passing through a jet but that almost any impurity, such as water droplets, would immediately

cause the gas to become charged. The influence might be nullified by the addition of a further impurity, such as an electrolyte. He found that the chemical nature of the material of which the jet is formed has a large effect.

Due probably to the fact that it is easier to work with waterfalls than with bubbles, not so much work has been done in the latter field. Most of those who have worked with bubbles have employed cataphoresis. Among these are MacBain and Williams,[23] Coehn and Mozer,[10] McTaggart,[24] Alty,[1] and Currie and Alty.[11] The work of the last three will be discussed more fully a little later. Among those who have worked on bubbling are Townsend,[29] who studied the charge on newly formed gas bubbles; Fischer,[13] who showed that the phases must be chemically different; Bloch,[4] who pointed out that a gas passing through an active and an inactive liquid successively or vice versa might not be charged at all; Kosters,[21] who tried with some qualitative success to relate the data found in bubbling experiment with that found in cataphoresis; Busse[6]; Kelvin, MacLean and Galt[20]; and Coehn and Mozer.[10] The work of these last investigators will be discussed again later.

Other workers have been interested in measuring the charge on the liquid. Thomson[28] did this, but the most interesting work of this kind (for us) was done by Baines[2] who was interested in the application of bubbling to flotation.

It should be noted that, while we are confining ourselves to a narrow field, much important work has been done in the wider field of balloelectrical phenomena, which may well be of tremendous importance to us if we find that there is a close relationship between the characteristics of small bubbles and of other small particles, or between the more general liquid-gas interface and other interfaces such as liquid-solid.

Important Procedures

In the field of cataphoresis of gas bubbles the most important work is that of McTaggart,[24] who was followed by Alty[1] and Currie.[11] They used a silica cell of diameter large in comparison with the size of the bubbles which they intended to use. The cell contained platinum electrodes and was rotated by means of a Raleigh motor. The progress of the bubble was followed by means of a low power microscope mounted beside the cell. They were able to study the effect of electrolytes, of the nature of the gas, of the curvature of the bubble, of its size, of time, of the rate of absorption of the bubble, and of different types of illumination. Alty seems very interested in interpreting his results as justification for his theoretical position.

Coehn and Mozer[10] have been the chief workers in the bubbling experiments although they have also worked on cataphoresis. Their method can be used for measuring the charge on either the liquid or the gas. They passed the gas (oxygen, hydrogen, or nitrogen) through a capillary flowmeter into a series of wash bottles and then into a grounded brass tube filled with metal scraps. This insured a uniform flow of clean gas free from electric charge. It was then bubbled through the liquid under investigation and over a platinum gauze which was connected with a quadrant electrometer. With this apparatus they report consistent results. They did, however, find that the nature of the gas had a considerable effect although several previous investigators had found that this was not so. In

every case a higher concentration of electrolyte was required to bring the solution to the isoelectric point when the gas was hydrogen than when it was oxygen.

Coehn and Mozer also carried out cataphoresis experiments in which they allowed a stream of small gas bubbles to rise between two platinum plates and measured the deflection of the stream of bubbles when a potential was applied across the plates.

Conclusions

There is as yet very little agreement in results between the different methods of studying the potential difference at the interface liquid-gas. This seems to be due chiefly to the great number of variables which must be rigidly controlled. Among these factors which it seems may be influential are the nature of the liquid, the nature of the gas, the presence of slight impurities in either phase, the size of the bubbles, the rate of bubbling, the age of the bubbles, the rate of absorption of the bubbles, the temperature, the thickness of the liquid layer, the shape of the bubbler, the chemical composition of the bubbler. Before any uniformity can be expected, considerable work must be done either on the elimination of the variable factors or on allowing for them.

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Textile Foundation Conference With Textile School Deans

A SEMI–ANNUAL conference of officials and representatives of the Textile Foundation with deans of the twelve textile schools co-operating in the former's educational program was held recently at Southern Pines, N. C. It followed a visit to the style show and textile exposition at North Carolina State College, Raleigh, N. C., the day before, and a luncheon tendered to the conferees and guests by Dean and Mrs. Harrelson of N. C. State College and Dean and Mrs. Thomas Nelson of the Textile School of that College.

Fredk. M. Feiker, director of the educational program for the Foundation, opening the first session, expressed the regret of the members over the illness of Edward T. Pickard, secretary of the Textile Foundation, under whose leadership this textile education movement has progressed.

Dr. John A. Randall, former president, Rochester School of Mechanic Arts, spoke on "Trends in Vocational Education." E. F. J. Lynch of the Bureau of Chemistry and Soils, Department of Agriculture, talked on "Recent Trends in the Development of Agricultural Fibres." Dr. A. H. Williams of the Wharton School of Finance and Commerce of the University of Pennsylvania, who has had prepared under his direction at the Wharton School, text books on textile economics, under the sponsorship of the Foundation, presented one of the finished books and lead a discussion of the best methods of getting them into the hands of students and others interested in this subject. The titles of the books are: "The Textile Industries—An Economic Analysis"; "Management of a Textile Business"; "Textile Costing—An Aid to Management," and "Textile Marketing." These may be procured through the office of the Textile Foundation, Commerce Building, Washington, D. C.

The deans were fortunate in having at one of their sessions the heads of some of the textile mills in North Carolina: C. S. Tatum, Pilot Cotton Mills, Raleigh; Sidney S. Paine, Tabardrey Manufacturing Co., Greensboro, and Carl R. Harris, Erwin Cotton Mills Co., Durham. They discussed "What the Mills Expect from Textile School Graduates."

In addition to the deans of the twelve co-operating textile schools and the speakers there were present at the sessions Franklin W. Hobbs, chairman, and Stuart W. Cramer, treasurer, of The Textile Foundation; Dr. Frank P. Graham, president, University of North Carolina, and W. M. McLaurine, secretary-treasurer, American Cotton Manufacturers Association.

Temperatures in Drying

Their Effect on Cost of Operation and Wear Resistance of Textiles*

By B. R. ANDREWS

THE manufacture of finished textile products is probably one of the oldest industries. In all the years since this industry has come indoors, drying between different operations in the production of fabrics has constituted a process vitally affecting quality. Because of its recurrence many times in the steps from raw stock to finished article, drying is a large item of cost. Yet progress, to date, in learning to dry the maximum quantity of first-quality goods at minimum expense seems altogether too small for the amount of attention that has been given to it by makers of cloth and manufacturers of equipment for its drying. Engineering aspects of drying where latent heat of vaporization is supplied by a gaseous medium are exceedingly complicated with an unusually large number of variables. Perhaps an attempt to view too many factors at once has retarded a more complete study of each individual factor or variable. This paper, therefore, is intended to deal only with temperature in drying with air or superheated water vapor.

Drier temperature affects character and quality of the fiber whether it be in raw stock, sliver, top, yarn, warp, or any of the various finishing operations. It affects the color, handle, and wearing quality. Whites can be yellowed by it; dyed goods can be shaded. Surface feel can be made harsh or soft. Handle can be changed in drying so that drape and ability to be creased or to retain such creases are altered enough to be recognized by the ultimate consumer. All of these effects take place at temperatures that vary with method of application of heat and relative quantity of moisture remaining in any of the fibers when they leave the drier, as well as the length of time the goods retain the heat absorbed.

Cost of Drying Affected by Temperature

Temperature in drying affects the cost of the operation, because required heat input, power to move the drying medium, and output of any given drier are all involved with the temperature used. Heat input to a drier suplies radiation and leakage losses from its exterior, heat in the exhausted vapor and drying medium, latent heat of evaporation of water from the material being dried, and increased sensible heat of that material.

Radiation losses can be cut to small values without making an expenditure for insulation that fails as a good investment. Leakage losses can be almost entirely eliminated if the housing is well-built. Loss out of the ex-

* Presented at a meeting of the Textile Division, Boston, Mass., Oct. 15, 1937, of The American Society of Mechanical Engineers. Reprinted from *Mechanical Engineering*, March, 1938.

haust fan is more involved. This is the item that is most affected by the drying temperature and the factor that determines the thermal efficiency of the drying machine in cases where the foregoing losses have been properly reduced.

The exhaust carries away the water vapor. Consequently, where air is the drying medium, the volume of exhaust is greatest when its water content is low and smallest when the water content is high. However, the capacity of the drier is highest when relative humidity is low, and lowest when the relative humidity is high. Therefore, high drier and consequent high exhaust temperatures give both high drier capacity and lower relative humidity in the exhaust, with a relatively small exhaust volume but a high total heat per cubic foot. If, however, superheated water vapor is the drying medium, it is always received by the drier from the water vaporized out of the material being dried at the temperature of vaporization, and the volume of the exhaust is only that of the water vapor evaporated from the product of the drier.

Operation at High Temperature More Economical

To apply the foregoing to an actual case so that the rather vague terms "high" and "low" can be more accurately determined, five imaginary driers are analyzed in Table 1. They are presumed to have like methods for disposing of the material in them and applying the drying medium and to be capable of fast drying. Each receives the same goods with equal wetness and delivers them with equal regain.

TABLE 1—ANALYSIS OF FIVE DRIERS

Drier no.	1	2	3	4	5
Drying medium	Air	Air	Air	Air	Superheated water vapor
Exhaust temperature, F.	180	180	180	280	280
Relative humidity of exhaust, per cent	5	15	35	5	....
Drier lengths, ft.	200	258	430	100	100
Steam per pound of water evaporated, lb[a]	4.50	1.98	1.63	1.70	1.25
Power required to circulate drying medium, hp	60	75	130	30	30
Steam and power cost per 1000 lb of water evaporated	$3.00	$1.93	$2.45	$1.23	$0.99

[a] Exclusive of sensible heat added to material.

The first three have an exhaust temperature of 180 F and operate with relative humidities of 5, 15, and 35 per cent, respectively; the other two have an exhaust temperature of 280 F. No. 4 uses air and exhausts with 5 per cent of vapor and No. 5 uses superheated water vapor only. Their size is adjusted so that each evaporates 1000 lb of water per hour. Power is charged at 1.25 cents per hp-hr and steam at 50 cents per 1000 lb. These figures are theoretical calculations based on well-established data, and, because no allowance has been made for leakage, they indicate a cost which

is slightly below possible commercial practice, yet they do parallel actual field results closely.

Circumstances may compel adoption of any one of the five combinations at times, but those operating with higher temperature are more economical to use and occupy the least floor space. Furthermore, while new plants are built from time to time and radical rearrangements of machinery are sometimes made, it is usually desirable, if not actually necessary, to make provision for increased production or reduced operating costs in floor space already allocated in existing machinery layouts. Such arrangements of equipment generally have also determined the number of operatives to each drier or range in which the drier is a part. Therefore, if a plant can increase the capacity of its drying units without enlarging them and at the same time reduce operating cost per unit of production, the total saving in the cost of manufacturing an article requiring four or five separate dryings is large.

Study of Drying Temperatures Now Being Made

A realization of this condition has manifested itself in the work now being undertaken by the U. S. Institute for Textile Research in a study of temperatures in drying. This should, in time, greatly augment the meager fund of information now available as to just how high a temperature can be used in a properly designed drier without detriment to the quality of the product dried. However, it will take years to get test information of this sort into usable form so that its findings can be applied to manufacturing operations. In the meantime, progress toward better drying can be materially hastened by a more general acquaintance with the accumulated knowledge of the effect of velocity and direction of application of the drying medium, the importance of the point at which the drying operation is discontinued, and the care of goods immediately after drying.

To produce goods that are suitable, all plants have been obliged to give much time and study to the effect of driers on their product. Drawing definite general conclusions from the results of their experience is difficult because of the many variable quantities previously mentioned and because few plants measure drier temperatures in the same way. Thermometers are frequently located where they are convenient to read rather than where they will indicate the temperature at the material. However, by taking temperatures at the material in a great many driers over a long period of years, it can be stated with some degree of accuracy that the maximum temperatures at the cloth given in Table 2 are in use by plants making high-grade goods and using no greater heat than they feel is consistent with quality. While these temperatures indicate an approximate cross section of today's practice, it should be borne in mind that higher temperatures are already being used.

TABLE 2—MAXIMUM TEMPERATURES AT THE CLOTH USED BY DRYING PLANTS, DEG. FAHR.

	Adequate circulation	Inadequate circulation
Cotton stock	270	240
Wool	250	160
Cotton piece goods	320	260
Worsted piece goods	250	180

Furthermore, when more accurate methods of reading the moisture content of delivered goods are available with dependable means of translating these continuous readings into drier speed, still higher temperatures can be used in these same driers because overdrying, which is now unavoidable, will be eliminated.

Fast-Dried Goods Have Greater Wear Resistance

Results of many years of work with textile driers and drying indicate clearly that economies of drying at higher temperatures are possible for many more textiles and textile plants than now enjoy them. In some cases, these savings can be made on existing driers, although in general, the existing method of applying the drying medium requires revision to protect the fibers and the quality. Tests made by Sampson, Gautreau, & Rolland in the laboratory of Andrews & Goodrich, Inc., on fabrics, the fibers of which had never been subjected to a temperature higher than 160 F, seem to emphasize the foregoing statement, and the following description, with analysis of one group of these tests, is given to indicate where the field of better drying seems to lie. Samples of white and dyed worsted gabardine were dried fast from 100 per cent wetness to 5 per cent at varying temperatures from 140 to 340 F with rapid, efficient air circulation. Another set was similarly dried except that it was left in the drier for 10 min after the 5 per cent point had been reached. Others were treated in the same way but slowly dried, with less rapid air circulation that was not so well applied.

These samples were tested for wear on a combination machine giving in sequence four smooth abrasions, one light blow from a hammer, and one light abrasion with emery paper, all under constant humidity and after like rest periods between drying and wear. Results of this test are illustrated in Fig. 1.

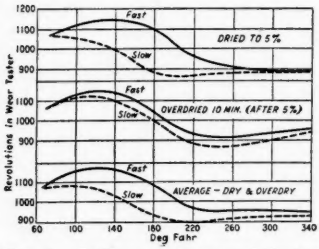

FIG. 1. Influence of rate of drying upon wear resistance.

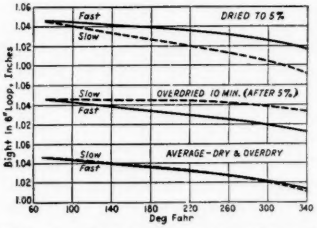

FIG. 2. Resistance to bending of gabardine samples.

Test pieces, after pressing, were each held together at their ends and accurate measurements made across the bight thus formed, to test for stiffness. Fig. 2 gives the results of this test. Again they were tested for ability to be creased and to recover their original shape, by measuring the change in the length of strips given nine creases. All samples were hung for the same time under the same condition of humidity and temperature before measurement. The results of these two tests are presented in Fig. 3.

Lastly, each sample was tested for elasticity by measuring its elongation under like tension per inch of width and for recovery by taking the time required for the piece to readjust its length. Fig. 4 shows the results of these elongation tests.

To avoid confusion, tests of chemical changes or tensile strength, regain, and the like are omitted, and consideration is given only to those measurable properties that enter into judgment of feel, handle, and appearance under the eye and use in the finished garment. However, as a matter of interest, the effect on tensile strength is given in Fig. 5.

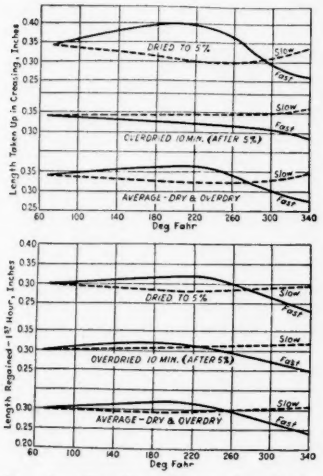

FIG. 3. Results of creasing tests. (Upper chart shows influence of rate of drying upon length taken up in creasing; lower chart shows the ability to recover original shape.)

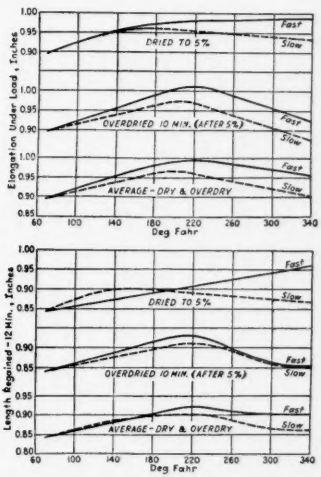

FIG. 4. Elongation under load and recovery. (After the samples had been subjected to similar loads for 12 min, they showed the results given in the upper chart. The lower chart shows the recovery of the samples in 12 min after removal of the load.)

From the results of those tests where the drying operation was stopped when the water in the cloth equaled 5 per cent of its dry weight, it can be stated that ability to resist this type of wear-testing machine decreases steadily from the use of drier temperatures of 140 to 180 F in the case of slow drying. Fast drying, however, actually increases resistance to wear at temperatures below 180 to 185 F and permits use of 70 to 80 deg higher temperatures than slow drying for like wear properties. Higher drying temperatures beyond these points make little or no change in the number of revolutions of the wear tester required to break the samples.

Recoverable elongation per unit of tension is greater for fast-dried and less for slow-dried goods for each succeeding temperature from 140 F up, but the rate of recovery for such stretching, expressed in percentage of its

elongation, is not appreciably affected by the temperature at which the cloth is dried unless temperatures above 200 F are used. Resistance to bending is also greater for fast-dried goods than for slow, and in each case is less for each succeeding temperature above 140 F. From 140 to 300 F, fast-dried goods take sharper pressed creases and hold them longer than those dried slowly.

If, however, the goods are overdried, little difference is found in ability to resist the wear-testing machine whether this drying is fast or slow. The curve goes down from 140 F until it flattens out at about 220 F. Recoverable elongation, while again slightly in favor of fast drying, increases from 140 F to about 220 F and decreases from that point to 340 F. Recovery

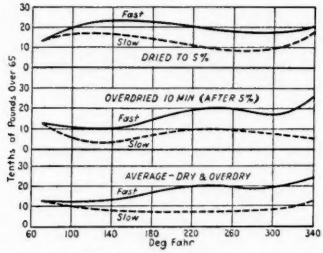

FIG. 5. Effect of drying rate on tensile strength.

from stretching is a little faster in slowly dried fabrics but does not vary much with the temperature at which they are dried. From the foregoing, fast drying at temperatures under 280 F appears to cause high-count worsted gabardines made from fine wool to stand up in the wear-testing machine longer, stretch easier, resist bending more, take pressing better, and hold it longer than slow drying, provided they are not seriously overdried. Furthermore, the same statement is true for fast drying at 240 F as against slow drying at 180 F.

Results of all of these tests are confirmed by the operation of production driers in finishing plants where contact with heated surfaces, if made at all, is intermittent and brief and the time to reach a condition of 5 per cent water content from well-extracted goods is no longer than 2 to 3 min for loose cotton or wool and worsted piece goods and from 10 to 30 sec for cotton piece goods. Analysis of the foregoing data indicates that for worsted cloth driers

(1) Higher temperatures improve drier economy.

(2) Higher temperatures are permissible for like quality if drying is faster.

(3) At any temperature, fast drying improves quality.

(4) Maximum temperature limits for like quality vary inversely with the drying time.

"Simplifying the Simple"

By W. H. WHITCOMB*

UNDER the title "Twist Measurements in Single Yarns" in the March, 1938, issue of TEXTILE RESEARCH, Prof. E. R. Schwarz gives a very interesting and valuable comparison of the several techniques employed for measuring turns per inch in single yarns. One of the three things mentioned as necessary in expressing twist in terms of turns per inch is the direction of twist.

In a discussion of the terms used to designate the direction of twist under the catchy subtitle "Simplifying the Simple," it is stated that the substitution of "S" twist and "Z" twist for the earlier "Left" and "Right" respectively, "has little merit except as a compromise," in spite of its being "a blessinig to those who cannot distiniguish their right hands from their left."

The textile manufacturers, in establishing their conventions, may or may not have been unscientific because of failure to adopt those of the scientist, the engineer, and the metal trade. It makes no difference whether these earlier conventions of "Left" and "Right" were tied up with the left and right hands, with the direction of rotation of some part of a machine, or what not. The situation that has developed is our concern. Is it a simple situation when "right," "regular," "reverse," and "left" are all used to designate the same direction of twist? If we could get the spinner, the twister, and the sewing thread manufacturers to agree to designate this direction of twist as right (or left for that matter), we would have attained the "simple." Such a simplification has repeatedly been attempted in spite of its evident hopelessness. For one branch to completely reverse its terminology and use "left" where it formerly used "right," and "right" where it formerly used "left" would only further confuse an already confused situation.

So long as the directions of twist are designated by the spinner as "right" or "regular," and "left" or "reverse," by the twister as "reverse" and "regular," and by the sewing thread manufacturer as "left" and "right,' respectively, no general definition of direction of twist employing any of these terms is possible. It is absolutely necessary to select designations which are not used by any branch of the textile industry, but which can be used by all to adequately designate direction of twist and do so without confusion. No one cares whether this constitutes a compromise or not, or whether it has "little merit as a compromise" or much merit as a compromise. What we are interested in is the merit of the new system as a means of designating the desired direction of twist so that any textile manufacturer can produce what is wanted without a moment's hesitation.

The introduction of the "S" twist and "Z" twist was for the purpose of eliminating at least two definitions of "direction of twist," using the

* Instructor of Textile Testing, Rhode Island School of Design, Providence, R. I.; Secretary, Committee D-13 on Textile Materials, American Society for Testing Materials.

same terms with opposite meanings. "S" twist now indicates the same form of twist to the spinner and twister of cotton, woolen, worsted, rayon, silk, spun silk and spun rayon yarns, namely, the helices or spirals run up to the left when the yarn is held vertically. The language of the sewing thread manufacturer is now the same as that of the cotton yarn manufacturer. To be sure, "Left" twist would also convey the same meaning if similarly defined, but, when the spirals run up to the left and the twist is designated as "Right," confusion is introduced. In this case, the designation as "S" twist not only eliminates all chance of confusion, but gives a visual picture of the direction of slope of the spirals.

The fact that only the printed letters S and Z (capitals are desirable but not essential) must be used in no way militates against their use or works a handicap on anyone. The horse-and-buggy-days of hand written specifications or orders have passed. Typewritten or printed forms are in vogue. Instead of being a disadvantage, there is a decided advantage, as is pointed out above, in the use of the printed form because it depicts clearly and briefly the desired direction of twist.

The merit of the "S" twist and "Z" twist designations is in their general applicability and not in their restricted use as merely now terms for "Left" and "Right" as applied to single yarns. That these designations have more than "little merit except as a compromise" is proven by their rapid and wide-spread adoption in this country and throughout the world.

"In any attempt to make science more effective in industry and through it more helpful to the public, certain obstacles must be met and overcome. First I would mention the so-called 'hard-headed practical business man'; a man without vision, imagination or enthusiasm for new things; a man who scoffs at theory or a college degree; a man whose sole criterion of proper practice is that which he has been accustomed to in the past; a man who spends as little as he can on research in order that his profits day by day may be larger. The withering policies of such men have driven many a flourishing business into obsolescence. If, by accident, a research laboratory has been set up in this man's company, its staff will be among the first to be fired in a depression, thus saving temporarily dollars but losing permanently the capital investment in trained intelligence."— **Dr. Karl T. Compton,** in *Scientific Monthly.*

Abstracts

Committee on Abstracts and Bibliography:
E. R. Schwarz, Chm., M. W. Weiss, Dr. E. J. Saxl, C. H. Clark.

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Address, C. H. Clark, Sec., 65 Franklin St., Boston, Mass.

I. Fibres (Synthetic and Natural) and Fibre Analysis

Elastic Properties of Wool and Its Structure. J. Speakman. *Tex. Mfr.*, Mar. 1938, P. 123–26.

A criticism of the paper by Sookne and Harris (*B. S. J. Rsch.*, Nov. 1937; *Am. Dye. Rptr.*, Nov. 1, 1937, P. 659) in which they advance the conclusion that decreased resistance to extension of wool fibres in acid solution is due to swelling rather than to salt-linkage breakage. Dr. Speakman's criticism is partially summarized as follows: "No attempt has been made in the preceding discussion to deal with all the errors in Sookne and Harris's paper, but it is hoped that sufficient has been written to indicate that their experiments with tanned fibres, dyed fibres, deaminated fibres and fibres in neutral salt solutions, do not invalidate the salt-linkage hypothesis. In no way does the evidence advanced in their paper justify the conclusion that 'salt-linkages . . . do not contribute appreciably to the physical stability of the fibre in aqueous solutions.' Apart altogether from what has been written in reply to Sookne and Harris's paper there is much evidence to the contrary in the published papers of this laboratory. Mention need only be made of the fact that salt-linkages have been shown to oppose folding of the keratin molecules from the state known as *a*-keratin to a more compact state, and that under the correct conditions the stress residing in the salt-linkages of stretched fibres may be great enough to rupture the fibre." (C)

STRESS-STRAIN CHARACTERISTICS OF WOOL AS RELATED TO ITS CHEMICAL CONSTITUTION. J. B. Speakman. *Am. Dye. Rptr.*, April 4, 1938, P. 168–71.

This is in large part identical with "Elastic Properties of Wool and Its Structure," J. Speakman. *Tex. Mfr.*, March 1938, P. 123–36. (C)

RE: STRESS-STRAIN CHARACTERISTICS OF WOOL AS RELATED TO ITS CHEMICAL CONSTITUTION. Milton Harris and Arnold Sookne. *Am. Dye. Rptr.*, April 4, 1938, P. 171–73.

In this communication the authors, who are research associates of the A. A. T. C. C. at the National Bureau of Standards working on the chemistry of wool, answer the criticisms of Dr. J. B. Speakman (*Tex. Mfr.*, Mar. 1938, P. 123–36; *Am. Dye. Rptr.*, April 4, 1938, P. 168–71) in connection with their recent paper on "Stress-strain Characteristics of Wool as Related to Its Chemical Constitution" (*Am. Dye. Rptr.*, Nov. 1, 1937, P. 659–66; *B. S. J. Rsch.*, Nov. 1937), in which he offers different interpretations for their experimental results. In an introduction to their detailed discussion they state: "In investigations dealing with the chemistry of proteins, considerable speculation is necessarily involved in the interpretation of data, and we fully realize that it is a relatively simple matter for different investigators to arrive at different conclusions from the same data. Unfortunately, Speakman does not appear to have examined our data critically and his interpretations are based on what we consider questionable hypotheses or on hypothesis that in our opinion can be shown to be invalid. It is the purpose of this letter to discuss his criticisms and to show that they have not altered our original interpretation of the data." . . . "In conclusion," the authors state, "we feel that our original interpretation of the data in question; namely, that the extensibility of wool fibres in aqueous solutions is governed for the most part by the factors which influence the swelling or hydration of the wool, has not been altered by the criticisms offered. Additional experimental evidence, which is now available, will be presented when time permits." (C)

CASEIN WOOL FIBRES: PREPARATION OF. A. Schpitalni and A. Valeschkevitsch. *Prom. Org. Chim.*, 1937, V. 3, P. 344–49 (through *Brit. Chem. Abs., B.*, 1937, V. 56, P. 1032); abs. in *J. T. I.*, Dec. 1937, P. A679.

Casein (I) is dissolved in 2% aqueous caustic soda containing 2% of carbon disulphide, and the solution spun in a precipitating bath containing sulphuric acid 120–420, sodium sulphate 240, and formalin 40 g. per litre; the fibres should be washed alternately with water and aqueous formalin. Fibres containing any desired proportion of (I) are obtained by adding a 50% (I)-water paste to viscose; the strength of the fibres is slightly lowered by inclusion of (I), to an extent increasing with the (I) content. (C)

CELLULOSE: EFFECT OF CHLORINATION ON THE PROPERTIES OF. S. Oguri and M. Takei. *Waseda Applied Chem. Soc. Bull.*, 1937, V. 14, No. 1, P. 1–5; abs. in *C. A.*, V. 31, Col. 3261; *Paper Trade J.*, Feb. 3, 1938, P. 42.

Chlorine treatment of cellulose at high temperatures has a harmful effect even for a short time but the treatment for 30 minutes at room tem-

perature does not cause any great lowering of the viscosity of the cellulose because of hydrolysis and there seems to be no material change in the cellulose. (C)

CELLULOSE: STRUCTURE. K. Freudenberg. *Papier Fabrikant*, 1937, V. 35, *Techn.*, P. 247–50; abs. in *J. T. I.*, Dec. 1937, P. A725.

The story of research into the structure of cellulose is divided roughly into three periods: (1) the demonstration of a long-chain structure, (2) from about 1921, investigations into the uniformity of the links in the chain, and (3) the application of X-ray spectroscopy. A long quotation is given from a paper by Böeseken in 1916, as early evidence of the conception of a chain with units linked by primary valencies. (C)

COTTON HAIR GROWTH RINGS: STRUCTURE. T. Kerr. *Protoplasma*, 1937, V. 27, P. 229–41 (through *C. A.*, 1937, V. 31, Col. 3960); abs. in *J. T. I.*, Dec. 1937, P. A713. (C)

FIBRE IN LINSEED STRAW: QUALITY OF. E. Slattery. *J. T. I.*, Jan. 1938, P. T1–T6.

The author states that "the investigations recorded in this paper were carried out upon a number of stalks, kindly supplied by the Imperial Institute, which were stated to have been grown for seed production." The retting, hackling, and additional preparation of the fibre were conducted on a laboratory, not commercial, basis. The testing and analytical procedure can be accepted as satisfactory, but the conclusions can be accepted only as applying to the fibre prepared as noted from this particular seed flax straw. The conclusions may be summarized as follows:

It was found that the linseed straw tested contained valuable fibre which could be obtained by chemical disintegration. The fibre had an ultimate cell about one inch in average length and varied in fineness from the root to the top of the stalk becoming about 34% finer after reaching two thirds the height of the stalk. It was very white and lustrous and not much unlike bleached mercerized cotton. The physical tests and measurements showed the fibre to be thicker and stronger than either Courtrai flax ultimates, or the coarsest cotton. It is obvious therefore that its use in the spinning processes would be limited to coarse counts of yarn. (C)

FIBRES: TREATMENT OF—WITH FISH ALBUMIN. P. P. Hiltner and Otto Mecheels. *Mell. Textilber.*, 1938, No. 1, P. 1.

The Deutsche Eiweißgesellschaft, Hamburg, began with the erection of a pilot plant in 1935 for the preparation of fish albumin according to the new process discovered by Herr *Hiltner* and Dr. *Metzner*. The product is sold as Viking Albumin and will not only keep for any length of time, but has also a very valuable molecular structure which is evidently superior to that of casein in several respects, but, unlike that product, it cannot be spun directly. The size of its molecule delays spinning, so that it must first be chemically treated. The authors are convinced that the size of the molecules does not thereby need to be much modified. The molecule of the finished fibre is still larger than that, say, of raw casein. Efforts to produce an animalized fibre from pure fish albumin that would have specially high stable properties were, however, soon abandoned and experiments were

made with an admixture of cellulose xanthogenate. Tests have shown that the albumin appears on the surface of the fibre enclosing a core of cellulose. The dyeing properties of these fibres are very similar to those of wool. Their washing strength and their tensile strength (1.6–1.9 g/den.) are satisfactory. The elongation is 8 to 12%. Spinning and weaving tests caused no difficulty. (C)

TECHNOLOGICAL REPORTS ON STANDARD INDIAN COTTONS, 1937. Nazir Ahmad. Indian Central Cotton Committee Technological Laboratory *Tech. Bull.*, Series A, No. 39, Aug. 1937.

The "standard Indian cottons, 1937" for which reports of technological tests are given in this bulletin, are mostly botanically pure types which have been selected with special reference to yield, ginning output, fibre properties and spinning performance; they are standards set up by the Indian agricultural department and represent cottons that have been grown in various provinces for several years and regularly subjected to comparative tests. The detailed results of these tests form the major part of this bulletin. Summaries of fibre properties and spinning test results are tabulated. (C)

VISCOSE-CASEIN-SOAP MIXTURE: SPINNING. S. Kobinata and H. Ishikawa. *J. Soc. Chem. Ind. Japan*, 1937, V. 40, P. 298B; abs. in *J. T. I.*, Dec. 1937, P. A679.

Experiments are described by tabulated data in which casein and soap were added to viscose (0.25 g. of casein to 20 gm. of original cellulose) and the mixtures were ripened for various periods and then spun in acid baths containing 10% of sulphuric acid, 20% of sodium sulphate and Zn and Al sulphates in three different proportions. The results indicate that viscose rayon of good wet strength can be spun by a suitable admixture of casein. (C)

II. YARNS AND FABRICS

DAMAGING OF WOOLEN FELT CLOTH IN THE MANUFACTURE OF PAPER. *Klepzig's Textil-Z.*, 1937, V. 40, P. 131–34; *C. A.*, V. 31, Col. 3270; abs. in *Paper Trade J.*, Feb. 17, 1938, P. 35.

The cloth used for the conductance of the fibre pulp through the presses and the drying drums and consisting of pure wool, cotton or asbestos or mixtures of these materials is often prematurely damaged. The various hazards are discussed, and the damage caused by them is shown in a number of illustrations. (C)

DEGUMMING OF SILK PIECE GOODS. Franz Weber. *Mell. Textilber.*, 1938, No. 1, P. 76.

The author describes briefly the usual equipment and processes for degumming silk, without claiming to be complete. Owing to the large number of different qualities of silk and local conditions, numerous special equipment and processes are found to be necessary, but they can all be reduced to two dominating basic tendencies: thorough degumming and rapid treatment, handling the silk as gently as possible. In that way the best results are obtained with the extremely sensitive material and its real quality is brought out. (C)

FIBRE CONTROL IN NOBLE COMBING. H. Smith. *Tex. Mfr.*, Jan. 1938, P. 3.

Main points at which fibre movement must be observed and controlled in combing wool on the Noble comb. (C)

FIBRE PROPERTIES AND SPINNING QUALITY OF INDIAN COTTONS: EFFECT OF DIFFERENT DEGREES OF COMPRESSION ON THE. Nazir Ahmad. Indian Central Cotton Committee Technological Laboratory *Tech. Bull.*, Series A, No. 40, Sept. 1937; *Tex. Mfr.*, Jan. 1938, P. 6, 14.

Three bales of each of four good quality Indian cottons were compressed to 40, 30 and 20 lbs. per cu. ft., respectively, and stored for about six months, after which samples for tests were drawn from them. The results of tests on these samples showed that pressing the bales to a density of 20 lbs. per cu. ft. might yield slightly better results in a few cases, though the effect is not general and its magnitude, in any case, is very small. The question whether this small improvement in the quality of the yarns is at all compatible with the higher cost of transport, etc., for the low density bales is discussed and the conclusion is drawn that reducing the density of the bale by diminishing the quantity of cotton in it would be an unprofitable step. The cottons used in this investigation were good quality types which are usually supplied in a comparatively clean condition. The position, however, may be different for dirty and leafy cottons and for such cases it would be necessary to undertake another investigation. (C)

MOISTURE IN RELATION TO TEXTILE MATERIALS. A. C. Goodings. *Canadian Text. J.*, Feb. 4, 1938, P. 35–7.

Outlines principles basic to regain standards. Explains why Bradford regain standards for wool products require critical revision, and why Canada needs moisture regain standards. (C)

OLEIN OR MINERAL OIL: SHOULD—BE USED FOR RECOVERED WOOL AND WOOLEN YARN? Dr. Kehren. *Mell. Textilber.*, 1938, No. 1, P. 27.

It has been found that very little is gained by using mineral oil either by itself or in admixture with saponifiable fatty acids for recovered wool and woolen yarn. It should never be forgotten that olein can be used for milling as well as a detergent for yarns when the cloth is to be milled later on. It is consequently more practical to use olein in these trades, not only because it makes the wool spin better, but also because it can be used for milling, while mineral oil only causes trouble and must be washed out with soap. (C)

RAMIE FIBRE. IV. WORKING RAMIE OVER FLAX MACHINERY. J. Barbour Pears. *Tex. Mfr.*, Jan. 1938, P. 4, 14.

Ramie can be processed on flax machinery when suitably prepared by retting. (C)

RAYON RESEARCH AT THE CROSS ROADS. A. J. Hall. *Silk J. and Rayon World*, 1938, Jan. 20, p. 46–7; Feb. 20, P. 37, 41.

The author describes many recent innovations in rayon manufacture and processing, noting that the position of rayon among textile fibres has

been much improved. While reviewing these developments and indicating the main line of future progress, he contends that the industry is in need of a fundamental discovery. (C)

RAYON THREADS: SHRINKAGE. E. Hensel. *Kunstseide*, 1937, V. 19, P. 336–38; abs. in *J. T. I.*, Dec. 1937, P. A716.

Measurements of the shrinkage in hot water and on drying of overstretched rayon threads in the acid spun state show that the amount of shrinkage increases with the temperature of the water bath and the drying temperature. By repeated wetting and drying it is possible to remove the internal tensions in overstretched threads and produce materials which do not shrink. In the acid state there is very little difference in the shrinkage characteristics of the beginning and the end sections of thread on the cake or bobbin but when bobbins of the spun thread are washed and dried the outer layers are able to shrink more than the inner layers in contact with the support. On twisting bobbins the positions of the ends are reversed and the shrinkage effects are compensated to a certain extent. A product which shows practically no shrinkage is obtained by wet twisting and then drying without a support. Rayon washed in cake form is also practically free from shrinkage tendencies. The results of extension, residual extension and shrinkage measurements on 120-denier threads are given and the relations between extensibility, shrinkage and dyeing properties are discussed. (C)

SILK FELT: PRODUCTION. S. Gandini. *Textilia*, 1936, V. 12, P. 279–80; abs. in *J. T. I.*, Dec. 1937, P. A701.

The felting of wool is discussed and the dependence of this property on the presence of a protein, "elastieum," of high hygroscopic capacity is pointed out. Felting properties may be imparted to silk by mixing with wool or with rabbit hair which has been rendered capable of felting by suitable chemical treatment. Felts for hats and for industrial purposes have been prepared from silk-hair mixtures containing up to 70% of silk, and silk-wool mixtures containing up to 50% of silk. The utilization of silk waste in this way as a means of reducing wool imports and the supply and cost of silk waste in Italy are discussed. (C)

SINGLE-BAND DRAFT SYSTEMS, THEIR DESIGNS, THE EXTENT TO WHICH THEY ARE COVERED BY PATENTS, AND THEIR SELECTION. H. Brüggemann. *Mell. Textilber.*, 1938, No. 2, P. 143; No. 4, P. 319. (C)

SPUN RAYON: NEW TRENDS IN. Kenneth B. Cook. *Daily News Record*, Jan. 28, 1938, P. 17.

Cites use of blends with other fibres, special finishes, and heavier deniers as interesting developments; also notes tendency toward use of longer staple lengths.

STANDARD OF REGAIN FOR WORSTED YARNS. *Wool Rec.*, 1937, V. 52, P. 829–35; abs. in *J. T. I.*, Dec. 1937, P. A697.

The dangers of excessive moisture content (especially mildew development) would be diminished by reducing the figure for the international

standard regain for worsted yarns (at present 18¼%). In 1925 the Wool Industries Research Association suggested 12.62% and this year (1937) at the international Wool Conference M. Burlet suggested 16%. The merits of these two suggestions are discussed. (C)

TENSILE STRENGTH OF COTTON YARN: EFFECT OF ROLL SPEED ON. B. B. Peacock. University System of Georgia, State Engineering and Experimental Station, Georgia School of Technology, Atlanta. Bulletin No. 1, Jan. 1938.

As a result of tests of 7700 skeins of yarn it is concluded that increased drawing roll speed results, in general, in an increased tensile strength of yarns produced. The effect of cork covered and metallic rolls (the latter of 1⅛" diameter and 1⅜" diameter) is discussed. The primary conclusion noted here would not seem entirely justified. Forty-eight broken line plots are included in the report, but only about one-third of these show a steady upward trend, and of these, a number show a total change in strength which (according to the author's own figures) is not significant. Further, about one-third of the plots actually show a downward trend for strength with increasing roll speed although again not all of these show significant changes. Particular emphasis was laid by the author on the use of statistical methods throughout the analysis. It is therefore unfortunate that this method was not extended to a discussion of the data. (S)

TRACING CLOTH: PRODUCTION. E. Herzinger. *Leipz. Monats. Text. Ind.*, 1937, V. 52, P. 239–40; abs. in *J. T. I.*, Dec. 1937, P. A702.

For the production of tracing cloth, cotton cambric is coated on both sides with a mixture containing starch, gelatin and various oils and, if desired, ultramarine or other blue dyes. The treated fabric is dried and cooled and later subjected to hot calendering with friction. Details of the procedure and the compositions of suitable coating mixtures are given. (C)

UNSHRINKABILITY IN WOOL GOODS. J. and J. C. Schofield. *Textilber.*, 1937, V. 18, P. 589–92; No. 4E, pp. 160–62; abs. in *J. T. I.*, Dec. 1937, P. A703.

A discussion of the changes produced in wool fibres and fabrics by processes which render wool unshrinkable. The various chlorination processes are described and their merits discussed and compared with those of the sulphuryl chloride process. (C)

VISTRA XT CHENILLE YARNS: PRODUCTION. *Spinner u. Weber*, 1937, V. 55, No. 36, P. 5–7; abs. in *J. T. I.*, Dec. 1937, P. A685.

The two methods of preparing chenille yarns are briefly described and the suitability of Vistra XT for use in the production of chenille yarns is pointed out. Vistra XT fibres have a twisted and curled structure and yarns and fabrics produced from them are similar to woolen materials. Tufts of these fibres in chenille yarns adhere well without requiring a specially strong binding by the core threads. Fabrics prepared from the chenille yarns are particularly suitable for bathing wraps. (C)

III. Chemical and Other Processing (Not Otherwise Classified)

Acid Wool Dyeing, Contributions to Theory of. Communication No. VI, cont'd. Processes in Dyeing of Wool with Palatine Fast Colors. W. Ender and A. Müller. *Mell. Textilber.*, 1938, No. 2, P. 181. (C)

Causes and Prevention of Inferior Fastness to Rubbing on Wool and Union Goods. *Mell. Textilber.*, 1938, No. 2, P. 191.

Inferior fastness to rubbing or crocking is to be observed during the various stages of the manufacture of cloth. Normal fastness to rubbing is produced when the dyestuff has formed its natural compound with wool. It may at once be assumed that poor fastness to rubbing will be present when foreign bodies are attached to the wool and prevent direct connection between the dyestuff and the wool fibre. Very serious mistakes may be committed in lubricating wool when emulsifiers are used for emulsifying the spinning oil that are easily affected by lime. Residues of grease and their effect on the fastness of the goods to rubbing are not always to be attributed solely to finishing faults. The addition of suitable assistants, such as Leonil SBS, in the carbonization of wool will considerably improve the fastness of dyeings to rubbing. The fastness of a dyeing to rubbing may also depend upon the way in which dyeing is carried out. Dyebaths that are not properly exhausted will result in dyeings that are less fast to rubbing than dyeings from a bath that has been well exhausted. Rapid increase of acidity and temperature of the dyebath may lead under certain circumstances to dyeings that are not fast to rubbing. Thorough rinsing of the dyed goods is always of importance for good fastness to rubbing. It is finally pointed out that poor fastness to rubbing is often complained of, when the fault is really inferior fastness to scraping. A brief definition of the two terms is given; they must not be confused when judging the qualities of a dyeing. (C)

(Dye) Fastness Problem in Relation to Textile Farbics: Review of. N. Hamer. *J. T. I.*, Jan. 1938, P. P5–P18.

A lecture, Nov. 1937, to a joint meeting of the London (Eng.) Section of the Textile Institute and the Society of Dyers and Colorists. (C)

Dyeing and Cleaning Textile Simultaneously. Washing at an Elevated Temperature. C. Schoeller. *Mell. Textilber.*, 1938, No. 1, P. 57.

The tests carried out by the author show that machine oil can be removed to a certain extent only by wet treatment, while the considerable residue is removed more extensively under the conditions described by Igepon T and alcohol sulphonates and is practically completely removed by Peregal O. Olive oil soap only gives results similar to those arrived at by Peregal O when considerably larger quantities are used in soft water; degreasing with soap in hard water has no real practical value, because the deposit of oil on the fabric could not be prevented. It was very plainly evident by the reddish coloration of the oil used in the tests for impregnation. A result approaching that obtained by the use of Peregal O can only be obtained with very large quantities of soap in hard water. No use

was made of soda, because that product is applied in the preliminary cleaning, and it is not customary to use it during dyeing, besides which most of the oils in question are non-saponifiable. The excellent degreasing effect of the levelling agent Peregal O is practically independent of the hardness of the water and is exerted at practically all the temperature ranges that come into consideration for the dyeing of rayon. It is by that means possible to dye knitted goods and the like very satisfactorily even when oily impurities are present. Further as a special case, two processes may be combined in one, whereby a certain parallel is offered to the application of levelling and cleansing agents, which are also non-ionogenic, in the dyeing of wool. (C)

INDIGOSOLS. M. Bader. *Chem. Ztg.*, 1937, V. 61, P. 741–44, 763–66; abs. in *J. Soc. Dyers Col.*, Jan. 1938, P. 40.

A detailed and comprehensive survey of developments in the manufacture of the Indigosols, with reference to relevant patents and literature, is followed by an account of their more important properties in connection with dyeing technique, *viz.*, solubility, substantivity and reduction potential. The survey concludes with a description of the applications of the Indigosols in the various dyeing and printing processes. (C)

(NEW) ORGANIC SYNTHESIS. A. Frank Bowles. *Am. Dye. Rptr.*, Jan. 24, 1938, P. 32–7.

Paper presented at Annual Meeting, A. A. T. C. C., Philadelphia, Dec. 4, 1937, describing the use of the ortho esters of weak organic acids as a new reaction in the synthesis of organic compounds. (C)

RESISTANCE OF DYESTUFFS TO HEAT. *Wool Rec.*, 1937, V. 52, P. 337–39, 352; abs. in *J. T. I.*, Dec. 1937, P. A700.

A discussion of alterations in shade due to low (below 100° C.) and high (above 100° C.) dry and moist treatments. (C)

STAPLE FIBRE YARNS: MERCERIZATION. K. Heide. *Kunstseide*, 1937, V. 19, P. 314–23; abs. in *J. T. I.*, Dec. 1937, P. A698. (C)

SYNTHETIC RESINS IN TEXTILE MATERIALS: USE OF. H. Roche. *Tex. Mfr.*, Jan. 1938, P. 30, 38.

An outline of present and prospective uses in finishing of substances classed as synthetic resins. (C)

WOOL DYEING METHODS: PRACTICAL CONSIDERATION OF MODERN. E. W. Pierce. *Am. Dye. Rptr.*, Jan. 24, 1938, P. 37–8, 51–2.

Paper presented at Annual Meeting, A. A. T. C. C., Philadelphia, Dec. 4, 1937. (C)

WOOL: TREATMENT OF—WITH QUINONE. *Wool Rec.*, 1937, V. 52, P. 703–5; abs. in *J. T. I.*, Dec. 1937, P. A703.

The properties of quinone are described and the precautions necessary in its handling. Quinone-treated wool (0.7–1.0% quinone is used on the weight of wool) has increased dyeing affinity, weight and strength, lustre, and stability to both bacterial and chemical attack. Quinone does not

confer full unshrinkability, but reduces felting. The two methods of treatment (with aqueous solutions and with vapor) are described. (C)

X-RAY STUDY OF THE DYEING OF WOOL. W. T. Astbury and J. A. T. Dawson. *J. Soc. Dyers Col.*, Jan. 1938, P. 6–16.

X-ray photographs of deaminated hair show that deamination leaves the keratin "grid" essentially unchanged, but destroys its property of being "set" by steam in the β-form. Potassium dichromate and the smaller acid molecules combine with the amino-groups to produce a similar effect, but they may be removed by prolonged washing with water and the setting power is restored. Such small molecules penetrate to all parts of the keratin complex and interfere even with the rapid setting which takes place first of all in the best organized regions of the fibre structure. Boiling with ammonium chloride results in a similar loss of setting power.

As judged by the action of the smaller acid molecules, acid dyes do not in general penetrate to the more inaccessible parts of the fibre structure, and, therefore, there cannot be any exact chemical equivalence between the total basic groups of keratin and the total acid groups of the dyemolecules taken up. Certain acid dyes occur in the body of the fibre also as free crystalline aggregates. The theoretical basis of these findings is discussed.

Indigo dyed wool contains elongated, partially oriented crystallites of the dye which may be further oriented by stretching the fibre. The X-ray photographs of certain free dyes are discussed. (C)

IV. Research Methods and Apparatus

BUILT-UP FILMS OF BARIUM STEARATE. Katharine B. Blodgett. *J. Phys. Chem.*, Oct. 1937, P. 975–84.

The use of interference colors to measure small changes of film thickness is described. Films of barium stearate built on a Cr. plate in a series of steps having a difference in thickness of two molecular layers between successive steps form an accurate color gauge with which the thickness of monolayers of other substances can be measured. A method is described whereby monolayers having a thickness of 5Å² or more are made visible to the eye and can be measured with a probable error of 2.5Å without the use of optical apparatus. The properties of barium stearate films containing Cu and some properties of skeleton films are discussed. (X)

FIBRE SURFACES: STUDY OF. A. Herzog. *Mell. Textilber.*, 1938, No. 1, P. 13.

In 1932 J. Manby and J. J. Hardy published an interesting process for the examination of the nature of the surface of wool fibres which consists mainly in half embedding the fibre in a medium, the optical behavior of which causes the disappearance of the back of the fibre. A special embedding medium known as ROX has recently been strongly recommended as being specially suitable for the purpose. The author criticizes the embedding process and points out the limitations peculiar to it. In regard to pigmented wool or wool containing a medullary structure, the results are unsatisfactory. He expresses the opinion that the process worked out by G. Saxinger and A. Herzog according to which an impression of the fibres is made in Kröning's coverglass cement, is much better adapted for the purpose. Excellent photomicrographs accompany the article. (C)